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THE WORK OF THE SCOTTSBLUFF RECLAMATION PROJECT EXPERIMENT FARM IN 1913.[1]

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INTRODUCTION.

The experiments conducted at the Scottsbluff Experiment Farm in 1913 followed the same general lines as in 1912.[2] These experiments include crop rotation, cultivation, methods of irrigation, the testing of various crops in order to determine those best adapted to the local conditions, and the testing of shade and fruit trees and of small fruits, vegetables, and ornamental shrubs. This work is all carried on under irrigation. About 30 acres of land on the farm is used for dry-land experiments conducted by the Office of Dry-Land Agriculture. In the present paper the progress of the work with irrigated crops in 1913 is briefly discussed. The arrangement of the fields and the location of the experiments in 1913 are shown in figure 1.

CONDITIONS ON THE PROJECT.

WEATHER CONDITIONS.

The climatological observations at the farm are made in cooperation with the Office of Dry-Land Agriculture and the Biophysical Laboratory of the Bureau of Plant Industry. The necessary apparatus is furnished by the Biophysical Laboratory.

[1] The Scottsbluff Experiment Farm is located on the North Platte Reclamation Project, 6 miles east of Mitchell and about 8 miles northwest of Scottsbluff, Nebr. The tract consists of 160 acres of land irrigated from the Government canal. Though the entire tract is irrigable, about 30 acres are devoted to dry-land experiments. The land was withdrawn from entry by the Department of the Interior for use as an experiment farm, and operations were begun in 1909. Three of the original buildings were erected by that department. The farm is under a superintendent detailed by the Office of Western Irrigation Agriculture. The work is supported by Federal appropriation through the United States Department of Agriculture and by State appropriation through the University of Nebraska. The buildings on the farm outside of the original three structures have been erected from State funds.

[2] For a report of the work of the farm in 1912, see Bureau of Plant Industry Circular 116, issued March 8, 1913.

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The weather conditions in 1913 were generally very favorable to field crops. The rainfall was less than in 1912, but somewhat more than in 1911. The period free from frost extended from May 2 to September 19, 140 days, which was longer than the frost-free period of either 1911 or 1912.

Table I summarizes the results of the climatological observations made during 1911, 1912, and 1913.

TABLE I.—*Summary of climatological observations at the Scottsbluff Experiment Farm, 1911 to 1913, inclusive.*

PRECIPITATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1911	0.45	0.10	0	2.31	0.81	2.13	1.28	0.65	2.14	1.10	0.08	0.34	11.39
1912	.20	.60	1.27	3.72	1.66	1.61	2.45	2.77	2.70	1.16	.37	0	18.51
1913	0	0	.60	.13	3.72	1.71	1.30	4.33	1.18	.47	.11	.80	13.75

EVAPORATION (INCHES).

1911	.....	.....	.....	5.54	7.15	8.90	9.08	7.43	6.18	.....	.....	.....	44.28
1912	.....	.....	.....	4.24	7.14	6.64	6.67	6.32	4.16	.....	.....	.....	35.17
1913	.....	.....	.....	2.11	6.32	6.80	6.93	6.64	4.69	.....	.....	.....	33.38

DAILY WIND VELOCITY (MILES PER HOUR).

Mean:													
1911	6.1	6.4	7.8	8.4	8.8	6.0	5.2	5.4	5.4	5.9	6.8	4.9	.....
1912	5.4	5.7	6.7	8.6	8.1	5.4	4.0	4.2	5.0	5.0	4.3	6.4	.....
1913	7.0	4.7	5.8	7.2	7.7	6.1	4.1	3.3	3.8	5.1	3.6	4.5	.....
Maximum:													
1911	15.9	13.7	15.8	14.6	15.2	10.8	8.4	9.2	11.1	12.2	15.6	8.4	.....
1912	12.4	14.7	15.3	31.4	16.6	15.9	6.0	7.0	11.5	10.8	12.6	15.8	.....
1913	22.9	8.3	15.7	18.3	14.9	16.7	9.1	6.9	8.0	15.9	8.2	11.7	.....
Minimum:													
1911	1.7	2.1	3.0	3.6	4.8	3.0	3.1	2.6	2.9	2.5	1.9	1.2	.....
1912	1.6	1.4	2.7	3.2	2.9	1.6	2.0	2.6	2.4	2.0	1.1	1.3	.....
1913	1.9	1.0	1.5	2.5	3.7	.1	.4	.2	.1	.8	1.1	.8	.....

MONTHLY TEMPERATURE (° F.).

Mean:													
1911	29	27	42	45	46	70	69	68	64	43	32	24	.....
1912	20	24	21	45	55	63	69	67	52	47	39	27	.....
1913	22	15	31	46	57	64	69	72	56	56	39	14	.....
Maximum:													
1911	68	64	74	80	88	95	94	98	93	78	66	62	.....
1912	53	50	55	73	87	93	91	96	89	83	71	56	.....
1913	[1] 58	61	67	84	90	95	97	97	90	83	73	36	.....
Minimum:													
1911	−19	− 7	11	11	22	42	40	41	38	11	−12	−11	.....
1912	−21	−14	−15	25	30	39	47	44	22	12	3	1	.....
1913	−28	−18	−11	16	26	41	37	50	24	12	13	− 9	.....

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Length of frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		° *F.*		° *F.*	*Days.*
1911	May 26	28	Oct. 3	31	129
1912	May 13	30	Sept. 16	31	124
1913	May 2	26	Sept. 19	31	140

[1] 11 days.

CROP CONDITIONS.

The crop conditions on the project were much more favorable in 1913 than they were in 1912. The average farm value of the crops grown was $14.40, as compared to $11.04 in 1912, the increase amounting to 30 per cent.

The 908 farm units on the project in 1913 comprised a total of 72,289 acres of irrigable land, of which an area of 56,829 acres was

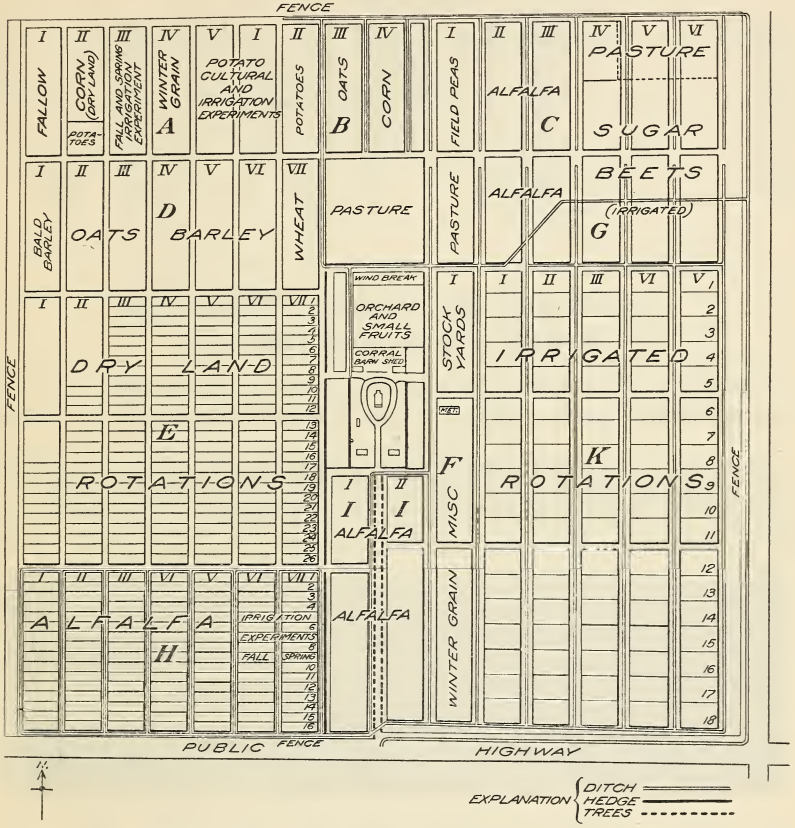

FIG. 1.—Diagram of the Scottsbluff Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1913.

actually irrigated. Of this, an area of 2,523 acres was in newly seeded alfalfa, which was not harvested, so that the area from which crops were harvested amounted to 54,306 acres. This harvested area was 7,055 acres greater than that in 1912, the increase amounting to 13 per cent. The acreage, yields, and farm value of crops produced in 1913 are stated in Table II, the figures being obtained from the United States Reclamation Service.

TABLE II.—*Acreage, yields, and farm value of crops grown on the North Platte Reclamation Project in 1913.*

Crop.	Area.	Yield.				Farm values.			
		Unit.	Total.	Per acre.		Per unit of yield.	Total.	Average.	Maximum.
				Average.	Maximum.				
	Acres.								
Alfalfa hay	27,298	Ton	61,728	2.3	4.5	$5.00	$308,640	$11.31	$22.50
Alfalfa seed	2,946	Bushel	3,108	1.1	4.0	8.00	24,864	8.44	32.00
Barley	2,331	do	49,522	21.0	75.0	.60	29,713	12.75	45.00
Corn	3,561	do	67,001	19.0	60.0	.70	46,901	13.17	42.00
Oats	8,590	do	211,599	25.0	100.0	.40	84,639	9.45	40.00
Potatoes	1,156	do	151,304	131.0	450.0	.45	68,087	58.90	202.50
Rye	928	do	6,273	7.0	20.0	.45	2,823	3.04	9.00
Sugar beets	2,920	Ton	32,739	11.0	21.0	5.50	180,065	61.67	115.50
Wheat	2,182	Bushel	32,489	15.0	35.0	.63	20,468	9.38	22.05
Pasture	1,200						9,600	8.00	
Forage	894						5,108	5.72	
Garden	300						5,712	29.04	
Total	54,306						786,620		
Value per acre								14.40	

EXPERIMENTS WITH IRRIGATED FIELD CROPS.

ROTATION OF CROPS UNDER IRRIGATION.[1]

The irrigated rotation work, which was started in 1912, occupies 80 quarter-acre plats. Nine of these plats are cropped continuously

FIG. 2.—General view of field K, Scottsbluff Experiment Farm, where the irrigated rotation experiments are being conducted. Thirty-one different cropping systems are being tested in this field.

with the different crops grown in the rotations. There are eleven 2-year, three 3-year, four 4-year, and four 6-year rotations. A general view of the rotation field is shown in figure 2. The following crops are used: Alfalfa, 21 plats; beets, 14 plats; corn, 6 plats; flax, 2 plats; oats, 18 plats; potatoes, 13 plats; spring wheat, 5 plats; and winter wheat, 1 plat. One plat of corn and one of alfalfa are harvested by hogs and are not included in Table III.

[1] These rotation experiments are under the direct supervision of Mr. James A. Holden, who prepared the report given in this paper.

Although these rotation experiments have been in progress only two years, some very interesting results have been obtained. These results are not considered as conclusive, but some of the indications are significant and they are briefly discussed later in this paper. The maximum, average, and minimum yields per acre secured in 1913 in the rotation experiments are given in Table III.

TABLE III.— *Yields of crops in the irrigated rotation experiments, Scottsbluff Experiment Farm, 1913.*

Number of plats.	Crop.	Yield per acre.			Number of plats.	Crop.	Yield per acre.		
		Maximum.	Average.	Minimum.			Maximum.	Average.	Minimum.
20	Alfalfa.....tons..	5.87	4.21	1.19	18	Oats.....bushels..	101.3	82.9	52.5
14	Beets.....do..	23.8	19.02	15.41	13	Potatoes.....do..	403.2	314.6	169.2
5	Corn.....bushels..	82.6	67.5	49.2	6	Spring wheat...do..	38.0	29.9	23.2
2	Flax.....do..	17.1	16.8	16.6	1	Winter wheat..do..	30.6	30.6	30.6

Table III shows that there was a rather wide range between the highest and lowest yields on plats growing the same crop. Each crop was seeded on the various plats at the same time, with the same kind of seed, and received the same cultural treatment after seeding, so that the differences in yield may be due in part to the sequence in the rotation and in part to the cultural treatments of the preceding crop. These differences are discussed briefly below.

Alfalfa.—Eight alfalfa plats are plowed up each year and eight plats are seeded, five in the spring on disked beet land and three on oat stubble in the fall, as soon as possible after the oats are harvested. The average yields in tons per acre in 1913 from the different seedings were 5.46 from the 1912 spring seeding, 4.07 from the 1912 fall seeding, and 1.27 from the 1913 spring seeding. Weeds came up very thickly on the 1913 spring-seeded plats, making it necessary to clip these plats twice during the early part of the summer, to prevent the weeds from producing seed. The weeds seemed to check the growth of the alfalfa as much as a nurse crop would have done.

The fall seeding of 1912 was done on August 20. The oat stubble was double disked and harrowed before seeding. In disking, the disks were set nearly straight, so as to leave as much of the stubble standing as possible and at the same time break the crust to form a mulch on the surface soil. The stubble appears to act as a protection for the young plants during the winter and spring and to prevent the light soil from drifting. Another advantage in leaving the stubble standing is that the seed can be drilled to a more uniform depth. Where the stubble is lying down to any great extent the disks of the drill ride over it instead of cutting through, and the seed is thus left on top of the ground. A weeder or light harrow should be run over the land after seeding. The one disadvantage of fall seeding is that it comes at a busy time, when it is difficult to get the grain off the land early

enough. From results so far obtained it seems that the alfalfa ought to be seeded not later than August 25. The different crops following the eight alfalfa plats that were plowed up gave the highest individual yield and the highest average yield of each crop in 1913, indicating very strongly that alfalfa has a beneficial effect on succeeding crops, even though, as in this case, the alfalfa has been on the land only one year.

Beets.—As beets follow the various crops in the rotations, it is possible, by comparing the yields, to get an idea of the effect these different crops had on the yield of beets in 1913. The average yields per acre were as follows: Three plats after oats, manured, 22.87 tons; 3 plats following potatoes, 20.76 tons; 1 plat following wheat, 18.09 tons; 6 plats following oats, 17.01 tons; and 1 plat following beets, 16.03 tons.

Each year in the rotations three oat plats on which beets are to follow the next year are manured at the rate of 12 tons per acre and plowed in the fall. Beets followed six other oat plats, which were fall plowed and received the same treatment as the manured plats except that no manure was applied. The first year of the experiments the manure was applied to the three manured plats in the spring. As the rotations were begun in 1912, only two years' results are available, but these results are pronounced. The increase in yield from the plats manured in 1912 was 3.3 tons; in 1913, it was 5.87 tons, or an average for the two years of 4.58 tons per acre. These increases, with beets at $5 per ton, amount to $16.50, $29.35, and $22.90, respectively. If the extra expense of harvesting this increased yield is not considered, the beets paid in 1912 $1.38 and in 1913 $2.44 per ton for the manure applied, or an average for the two years of $1.91. This emphasizes the value of manure when applied to land to be planted to beets. It should be noted in this connection that the difference in favor of manure in 1912 was much less than in 1913. In 1912 the manure was applied in the spring, while for the 1913 crop it was applied the preceding fall.

In the early spring of 1912 all the beets were more or less damaged by wind. Five plats on the rotation field were so badly damaged that they were reseeded on June 1, and a perfect stand was obtained. Nine other plats, not so badly damaged, were not reseeded. Six of these plats were on the same kind of land and received the same treatment except the time of seeding. These six plats had an average of 75 per cent stand. When harvested, the early-seeded beets, with only 75 per cent stand, yielded on an average 3.9 tons per acre more than the reseeded plats which had 98 per cent stand. As there is a big expense attached to the reseeding and a chance of getting a poor stand from the second seeding, it is doubtful whether it will pay the farmer to reseed his beets, even though he has only one-half or one-third of a stand.

It is not a good practice to economize too much on seed. With ideal conditions, 15 pounds of seed per acre is sufficient; but if the

surface soil becomes packed by rain or if other unfavorable conditions are to be anticipated, 20 pounds per acre is a safer rate than 15 pounds.

Corn.—A local calico variety was used in the rotation experiments. The seed used was grown on the experiment farm the previous year, it being the earliest matured ears that were gathered from the field before the main crop was harvested in 1912. The ears were hung in the seed house during the winter. In the spring each ear was tested separately for germination. The yields in bushels per acre of corn, 1 plat in each case, following the different crops, were as follows: Following alfalfa, 82.6 bushels; oats, 69.2 bushels; beets, 68.4 bushels; potatoes, 67.6 bushels; and corn, 49.2 bushels. There was practically no difference in the yields from the plats following oats, beets, or potatoes, while the yield of corn following corn was low and that of corn following alfalfa was high.

Flax.—The yield of flax was low, due, perhaps, to light seeding. Had 45 pounds per acre instead of 30 pounds been seeded, the yield would probably have been higher. Flax on corn land yielded 17.1 bushels and on flax land 16.6 bushels per acre.

Oats.—Oats were seeded at the rate of 11 pecks per acre. A variety known as Colorado No. 13 was used. Where oats followed corn, beets, and potatoes, respectively, the land was prepared by spring disking, but where oats followed an uncultivated crop the land was fall plowed.

The average yield of oats in bushels per acre from the plats following various crops was as follows: One plat following alfalfa, 101.3; 8 plats following potatoes, 92.1; 2 plats following beets, 89.4; 1 plat following flax, 86.5; 2 plats following wheat, 74.4; 1 plat following oats, 72.8; and 3 plats following corn, 55.9 bushels. There was a marked difference in the yield of oats following corn and that following potatoes or beets. As these plats all received the same treatment after the respective crops were harvested, the difference in yield appears to be due to the sequence in the rotations and to treatment of the previous crop.

Potatoes.—The White Pearl variety was used. The seed tubers were hand picked from the crop grown on the rotation field in 1912. Large seed was used, requiring on an average 34.4 bushels per acre.

The yields in bushels per acre of potatoes following the different crops in the rotations were as follows: Four plats after alfalfa, 379.3; 3 plats after beets, 360.3; 1 plat after oats, manured, 348.4; 1 plat after beets, manured, 316.2; 1 plat after corn, 241.2; 1 plat after oats, 234.6; 1 plat after potatoes, 192; and 1 plat after oats-rye,[1] 169.2. As will be seen, when potatoes followed oats which were manured the yield was 113.8 per acre more than on the oat plat without manure. Manure on beet land, however, did not increase

[1] Rye planted in the oats stubble and plowed under as green manure the following spring before potatoes are planted.

the yield of potatoes; in fact, the potato yield on manured beet land was less than on unmanured beet land. It was also less than on the manured oat plat, whereas the yields from the beet plats not manured were much higher than the yield from the unmanured oat plat. The oat plat was manured and plowed in the fall, but the beet plat was not manured and plowed until spring. This may explain why the manured oat plat yielded higher than the manured beet plat. The average yield per acre from the plats following alfalfa, beets, manured oats, and manured beets was 349.3 bushels, while the average yield from the plats following corn, oats, oats-rye, and potatoes was only 209.2 bushels, or a difference of 139.8 bushels per acre in favor of manuring or plowing under alfalfa. (See fig. 3.)

FIG. 3.—Potatoes in rotation 44, 50 days after planting in 1913. Potatoes follow alfalfa in this rotation. The yield of this plat was 403.2 bushels per acre, which was the highest yield obtained in 1913. Potatoes have done extremely well when planted after alfalfa.

Wheat.—The yield in bushels per acre of College Defiance spring wheat following the different crops was as follows: One plat after alfalfa, 38; 1 plat after beets, 33.3; 2 plats after wheat, 27.1; and 1 plat after oats, 23.2. Winter wheat following wheat yielded 30.6 bushels per acre.

Summary.—By a careful study of these results, it will be seen that in every case where the crops followed alfalfa the highest average yields were obtained, indicating very strongly that the alfalfa had a beneficial effect on the succeeding crops. Manure on oats stubble greatly increased the yields of beets and potatoes the following year. The yields of the crops following beets and potatoes were very good, almost as good as those obtained with crops following alfalfa or grown on manured oat land.

Crops following corn were rather poor. This was particularly noticeable in the case of oats. Perhaps the most striking effect of a

previous crop on yield was in the case of oats following corn, beets, and potatoes, respectively. These plats were not plowed, but were disked in the spring, seeded the same day, and received the same treatment throughout the remainder of the season as the other oat plats, but the yield of oats following corn was 36.2 bushels per acre less than that following potatoes, and 34.5 bushels per acre less than that following beets. As the stands and the treatment of these plats after planting were practically the same, the differences in yield appear to be due to the previous crops and their cultural treatment. Oats following fall-plowed flax, oats, and wheat, respectively, were fairly good. Wheat following oats was poor. The yields from continuous cropping were in most cases low.

FIG. 4.—Pigs on alfalfa pasture in rotation 65. The net value of the gains in weight of the hogs on this quarter-acre plat in 1913 was $49.24, or $196.96 per acre.

Hogging alfalfa.—Each year in one of the rotation experiments a one-fourth-acre plat of alfalfa and a one-fourth-acre plat of corn are harvested by hogs. This work is done in rotation 65, which is a 6-year rotation of corn, flax, oats, and three years of alfalfa. While on alfalfa pasture the pigs receive 2 pounds of corn daily for each 100 pounds of live weight. The alfalfa plat is divided into two equal parts, and the hogs are pastured alternately on the two divisions. The hogs used in these experiments in 1913 were pure bred Duroc-Jerseys. During the season two lots of hogs were used. Fall-farrowed shotes were used from May 2 to July 2 and spring-farrowed pigs from July 6 until the end of the growing season. Figure 4 shows the second lot of pigs on the pastured plat on August 13. The five

fall-farrowed shotes weighed a total of 544 pounds when they were turned on the one-fourth-acre alfalfa plat, on May 2. The alfalfa on this plat was second-year alfalfa, having been seeded May 6, 1912. The five shotes were all the plat could possibly pasture up to July 2, when they were taken off. At this time the five hogs weighed 925 pounds. During the time the five shotes were on pasture they were fed 18.7 bushels of ear corn. The hogs gained 381 pounds in 61 days from the one-fourth acre of alfalfa pasture and 18.7 bushels of corn. The daily gain was 0.86 per cent.

On July 6 eight spring pigs, weighing a total of 272 pounds, were put on the alfalfa plat from which the five shotes had been removed. It was soon apparent that these eight pigs would not keep the pasture fed down, and four more, which weighed a total of 139 pounds, were added on July 20. Even the 12 pigs were unable to keep the pasture fed down during the early part of the period, and it was necessary to clip each half of the plat once. The 12 pigs were kept on this plat until September 10, when the 6 largest were removed and put on the corn plat, while the 6 smaller ones were retained on the alfalfa plat until September 30. The total weight of these 12 pigs when turned on the alfalfa plat was 412 pounds and when taken off, 1,019 pounds. While on pasture they were fed 22.6 bushels of corn. From one-fourth acre of alfalfa pasture and 22.6 bushels of corn the hogs made 607 pounds of pork from July 6 to September 30. The daily gain was 1.22 per cent.

During the whole season the hogs produced from the one-fourth-acre alfalfa pasture and 41.3 bushels of corn a total of 988 pounds of pork. Figuring this gain at 7.5 cents a pound and the cost of the corn fed at 60 cents a bushel, the local market prices at the time the experiment closed in 1913, the hogs returned an equivalent of $49.24 for the one-fourth acre of alfalfa pasture. On an acre basis, after deducting the cost for corn fed, the first lot paid $1.14 and the second lot $1.48 daily for alfalfa pasture, or $1.34 daily from May 2 until September 30. In other words, the hogs returned, after paying 60 cents a bushel for the corn fed, an equivalent of $196.96 per acre of alfalfa pasture.

Eleven similar plats of alfalfa were cut for hay and yielded an average of 5.46 tons per acre. Assuming that the yield from the pastured plat would have been the same as that from the 11 similar plats, the first lot of hogs paid an equivalent of $37.71 per ton for the first cutting and the second lot paid $35.33 per ton for the second and third cuttings, or an average for the season of $36.13 per ton for alfalfa hay. To this must also be added the value of the manure left on the land.

Hogging corn.—The six largest pigs from the second lot, which were taken from the alfalfa plat on September 10, were turned into the

corn plat on the same date. At this time these pigs weighed 547 pounds. The corn was well along in the "denting" stage when the hogs were turned in. While on the plat the hogs received no supplementary feed except small quantities of salt, slack coal, and rock phosphate, for which no charges are here made.

The hogs were on the corn plat 28 days. When they were taken off they weighed 800 pounds, having gained 253 pounds from the one-fourth-acre corn plat, or 1,012 pounds of pork per acre. This, at 7.5 cents a pound, is equivalent to $75.80 per acre. The daily gain was 1.30 per cent. A similar corn plat in the rotations yielded at the rate of 82.6 bushels of corn per acre. Both of these plats followed alfalfa, and as far as could be judged would have yielded about the same. Assuming that the yields from these two corn plats were the same, the hogs paid an equivalent of 93 cents a bushel for the corn in the field.

Figuring corn at 60 cents a bushel and allowing $10 per acre for alfalfa pasture, each pound of pork put on the hogs in the different lots cost as follows: The first lot on alfalfa, 3.1 cents; second lot on alfalfa, 2.5 cents; and the lot on corn, 4.9 cents.

GRAIN VARIETIES.

Wheat and rye.—The number of wheat varieties grown was reduced from 9 in 1912 to 7 in 1913. The discarded varieties were the Chul and the Beloturka. The Chul has been a poor yielder at the experiment farm, and it has a very weak straw and has produced grain of an inferior quality. The Beloturka yielded well, but being one of the durum wheats it is not readily marketed locally. The spring wheats were grown in triplicate one-tenth-acre plats in 1911 and 1912 and in duplicate plats of the same size in 1913. The average yields obtained during the three years 1911 to 1913, inclusive, are shown in Table IV.

TABLE IV.—*Average yields of seven varieties of spring wheat under irrigation at the Scottsbluff Experiment Farm in 1911, 1912, and 1913.*

Variety.	Yield per acre.	Variety.	Yield per acre.
	Bushels.		*Bushels.*
Ghirka	37.6	Galgalos	34.6
Defiance	36.9	Rystings Fife	34.4
Sambahara	36.4	Bluestem	31.9
Preston's Defiance	34.9		

There was no difference in the time of ripening of these varieties. Ghirka, the highest yielding variety, is a red wheat of good quality. Defiance, the second highest in yield, is a soft white wheat of excellent quality. It does not stool as freely as the Ghirka, but it has a longer straw.

No new varieties of winter grain have been added. The same winter wheats and ryes have been grown for three years. The average yields of the winter wheat and rye varieties for the three years 1911 to 1913, inclusive, are stated in Table V.

TABLE V.—*Average yields of seven varieties of winter wheat and three varieties of rye under irrigation at the Scottsbluff Experiment Farm in 1911, 1912, and 1913.*

Variety.	Yield per acre.	Variety.	Yield per acre.
	Bushels.		*Bushels.*
Wheat: No. 1	34.8	Wheat: Crimean 1435	30.8
Kharkof 1583	34.6	Turkey 1558	30.5
Crimean 1437	32.8	Rye: Minnesota No. 2	27.3
Turkey 1571	32.6	Twentieth Century	25.1
Kharkof 1442	31.7	Dwarf	25.0

All of the winter wheats are bearded varieties. In the fall of 1911 several beardless varieties were planted, but none survived the winter. The early fall seeding of winter wheat, during the first two weeks in September, is recommended, as it gives the grain a chance to make enough growth before winter sets in to prevent the drifting of the soil.

Rye is a good crop to grow where rapid growth is desired in order to prevent soil from drifting. It is also valuable as a winter cover crop and for early pasture in the spring. As a grain crop, rye is not as profitable as the other small grains. The market for rye is limited, and as a feed it ranks below wheat.

Barley.—Thirteen varieties of barley were grown in 1913. Several varieties grown in 1912 were discarded on account of their low yield, and two new varieties were added. It has been found that all of the beardless or hooded varieties tested up to this time are very poor yielders. The bald or hull-less varieties also are relatively low yielders.

The average yields of the barley varieties are shown in Table VI.

TABLE VI.—*Average yields of 16 varieties of barley under irrigation at the Scottsbluff Experiment Farm in 1911, 1912, and 1913.*

Class.	Variety.	Number of years grown.	Yield per acre.
			Bushels.
Bald, or hull-less	G. I. No. 262	3	28.8
Do	S. P. I. No. 12709	3	28.2
Do	White hull-less	2	18.4
Do	Unknown	2	39.0
Two-row, bearded	Franconian 680	3	53.0
Do	Hannchen 531	3	44.3
Six-row	Mariout	3	45.2
Do	California Feed	3	46.6
Do	Scotch	3	51.0
Do	Thomas	3	42.6
Hooded	Hooded	3	28.5
Six-row	S. P. I. No. 30393	2	68.9
Do	Barbary 26179	2	46.9
Do	No. 90	2	59.8
Do	Oderbrucker	1	47.5
Hooded	Hooded 2-row	1	46.2

Although Franconian, a 2-rowed variety, has given the highest average yield for a term of three years, it has not produced the highest yield each year.

In rank of quality of grain for feeding purposes the Franconian would probably be placed first, on account of its large, plump grain and comparatively thin and light hull. The Scotch variety would rank second, and the Thomas third. The California Feed, though a good yielder, has a very persistent awn, or beard, and a very coarse hull, and therefore it is not so desirable for feeding.

Oats.—Seven varieties of oats have been tested for three years. One variety of side oats was added in 1913. The low yield of the side oat is attributed to the fact that it was not acclimated. The seed was secured in the East. The yields obtained are given in Table VII.

TABLE VII.—*Average yields of seven varieties of oats under irrigation at the Scottsbluff Experiment Farm, 1911, 1912, and 1913.*

Variety.	Number of years grown.	Yield per acre.	Variety.	Number of years grown.	Yield per acre.
		Bushels.			*Bushels.*
Colorado No. 13 (New Market)	3	78.5	Swedish Select	3	70.6
Colorado No. 37	3	74.1	Sixty-Day	3	68.5
No Name	3	73.9	Garton's	2	57.0
Victory	3	72.0	White Russian (side oat)	1	53.7
Danish	3	71.0			

Although the Sixty-Day oat is one of the lowest in yield, it is the earliest to mature. The early maturity is an advantage, especially where hail is apt to destroy a crop. It is desirable to use this variety as a nurse crop for alfalfa, on account of its short straw and early maturity.

The side oat matured fully three weeks later than the Sixty-Day oat and required one more irrigation. Garton's oat was eliminated in 1913 on account of low yield and high percentage of empty hulls.

Corn.—In 1913 fourteen varieties and crosses of corn were planted in duplicate plats. The average yield of all varieties was 33.5 bushels of ear corn per acre. The highest single yield was 43 bushels per acre, produced by Blue Squaw corn. The highest average yield was obtained from U. S. Selection No. 133, which averaged 38.7 bushels per acre. Calico corn, the variety most commonly grown on the project, yielded 35 bushels per acre. Though the Blue Squaw produced the highest yield, this yield is more apparent than real. This corn has a very shallow grain and an extremely large heavy cob, making the percentage of grain very low.

Grain sorghums.—For three years a number of varieties of milo and kafir have been tried. The season in western Nebraska is too short to mature these crops. A few scattering mature heads were secured

each year, but never enough to indicate that the culture of grain sorghums will be profitable under irrigation in western Nebraska.

STOCK BEETS.

The use of beets for feeding live stock on the North Platte project is increasing in importance. Sugar beets are being used very extensively for this purpose, but they do not ordinarily yield as heavily as stock beets and it seemed desirable to make a comparative yield test of these two classes of beets at the experiment farm. Accordingly, three varieties of stock beets were tested in comparison with sugar beets in 1913. The yields obtained are stated in Table VIII.

TABLE VIII.— *Yields of sugar beets and stock beets at the Scottsbluff Experiment Farm in 1913.*

Variety.	Yield per acre.	Variety.	Yield per acre.
	Tons.		*Tons.*
Sugar beets	18.0	Giant Red, stock beets	36.5
Yellow Tankard, stock beets	38.1	Half Sugar, stock beets	32.0

The average yield of the three varieties of stock beets was 35.5 tons per acre, or nearly twice the yield of sugar beets. There seems to be no doubt that for feeding purposes it is desirable to grow stock beets rather than sugar beets.

FIELD PEAS.

Six varieties of field peas were planted in 1913, i. e., Kaiser, Norcuss, Colorado, Gray Winter, S. P. I. No. 24895, and S. P. I. No. 11200. Although the crop was seriously damaged by a hailstorm in early May, it made a new growth and produced a fair crop. This was the third year that field peas had been tried on the experiment farm. The growth and yield do not warrant the growing of this crop under irrigation in western Nebraska. The highest yield obtained so far was with S. P. I. No. 11200, which produced 23.5 bushels per acre in 1912.

COWPEAS.

A number of varieties of cowpeas have been grown in small plats at the experiment farm since 1911. Only one variety, the Buff, has matured seed. Enough mature seed was secured in 1913 to grow the Buff cowpea on a large plat, and its value as a forage crop under irrigation will be tested in 1914.

VETCHES.

Of the five varieties of vetches grown, hairy vetch (*Vicia villosa*), *V. angustifolia, V. atropurpurea, Lathyrus sylvestris,* and *L. cicer,* only one, the hairy vetch, which is planted in the fall, has proved a success. It goes through the winter with little or no injury and starts a vigor-

ous growth in the spring. The spring-planted varieties have all failed to make satisfactory growth. There appears to be no economic reason why vetch should be grown on the North Platte project unless it could be used as a pasture for cattle. A trial of vetch pasture will be made in the summer of 1914.

PASTURES.

In view of the increasing importance of live stock, particularly dairy farming, on the North Platte project, it has seemed desirable to determine whether pastures could be made profitable on the irrigated lands of the project. For this purpose some preliminary experiments were started in 1913.

Eleven different grasses and three clovers were seeded in the spring of that year. The grasses and clovers planted separately in small plats were tall oat-grass, Italian rye-grass, smooth brome-grass, timothy, redtop, bluegrass, wheat-grass, orchard grass, meadow fescue, tall fescue, perennial rye-grass, red clover, alsike clover, and white clover. Each of these grasses and clovers was also used in three grass mixtures. In one of the mixtures all of the grasses were used; the second mixture was the same as the first, except that alfalfa planted at the rate of 2 pounds per acre was used with it; the third mixture was the same as the second, except that white clover and alsike clover were added at the rate of 2 pounds each per acre.

All the grasses made a good growth during the summer except the wheat-grass, redtop, timothy, bluegrass, and orchard grass. On account of the poor stands secured with these, it was found necessary to reseed them in the fall. The mixtures made a good growth and covered the ground completely before winter and could have been pastured lightly without any damage to the stand. It is expected that pasturing tests will be made with these mixtures in 1914.

FALL IRRIGATION.

An experiment to determine the value of fall irrigation has been conducted since 1911. The first year the work included wheat, barley, and oats. Corn, potatoes, and sugar beets were added in 1912. In this experiment the fall-irrigated plats were heavily irrigated in September each year, while the other plats were not irrigated in the fall. During the growing season of the crops all the plats were treated uniformly. The plats used were one-tenth of an acre in size. In 1911 and 1912 the experiment was conducted on triplicate plats, but in 1913 only the corn plats were triplicated, the others being duplicated. The results of three years' work are summarized in Table IX, which gives the average yields per acre and the increases in favor of fall irrigation in bushels or tons per acre and in percentages.

TABLE IX.—*Results of fall irrigation at the Scottsbluff Experiment Farm in 1911, 1912, and 1913.*

Crop.	Number of years.	Average yield per acre.		Increase in favor of fall irrigation.	
		Fall irrigated.	Not fall irrigated.	Per acre.	Per cent.
Wheat.....bushels..	3	33.2	27.8	5.4	19
Barley.....do....	3	36.9	29.9	7.0	23
Oats.....do....	3	83.8	72.8	11.0	15
Corn.....do....	2	59.1	48.5	10.6	22
Potatoes.....do....	2	125.0	122.6	2.4	2
Sugar beets.....tons..	2	12.3	10.7	1.6	15
Average increase in favor of fall irrigation.....	.....	.....	.....	.....	16

As shown in Table IX, fall irrigation increased the average yield of all the crops. In the case of potatoes the difference was too small to be considered significant, but with the other crops the increases in yield were marked. The average increase in yield of all the crops in favor of fall irrigation amounted to 16 per cent.

CULTURAL TESTS WITH SUGAR BEETS.

The experiments with sugar beets include methods of cultivation, depth of plowing, distance of planting, and time of irrigation. All these experiments are conducted in duplicate plats.

Methods of cultivation.—In 1912 and again in 1913 three different methods of cultivation were tested. All the plats were cultivated at the same time during the growing season, but the depth of cultivation was varied. Two plats were cultivated deep; that is, the teeth of the "deer-tongue" cultivator were made to go into the soil about 3 inches deep at each cultivation. Two plats were cultivated deep at the first cultivation by running a plow at a depth of about 3 inches, and thereafter with decreasing depth each time, a cultivator with knife attachments being used. The two other plats were cultivated shallow, 1½ to 2 inches, throughout the season, the knife attachments being used. The average yields for the two years were for deep cultivation, 16.3 tons per acre; for deep cultivation followed by shallow cultivation, 18.3 tons per acre; and for shallow cultivation, 19.1 tons per acre.

Observations made on these plats indicated that the lateral roots of the beets were damaged by deep cultivation, particularly during the latter part of the season, and it appears likely that the lower yields obtained with deep cultivation were due to this damage.

Depth of plowing.—The depth-of-plowing test was carried on in 1912 and 1913. In 1912 the beets were planted on spring-plowed stubble land, and in 1913 they were planted on fall-plowed potato land. The plowing was done at five different depths. The average yields for the two years are given in Table X.

TABLE X.—*Average yields of sugar beets on land plowed to varying depths at the Scottsbluff Experiment Farm in 1912 and 1913.*

Depth of plowing.	Yield per acre.	Depth of plowing.	Yield per acre.
	Tons.		*Tons.*
4 inches	21.1	16 inches	20.0
8 inches	18.3	20 inches	19.0
12 inches	18.8		

While the results were not consistent, the highest yield was obtained from shallow plowing. The effect of varying the depth of plowing probably would differ on different soils. The soil at the experiment farm is a light sandy loam and probably does not require as deep plowing as heavier soils.

Distance of planting.—In 1912 and 1913 beets were planted in rows different distances apart and thinned to different distances within the row. Rows were planted 20, 24, and 28 inches apart, and in each of these plantings the beets were thinned to 6, 9, 12, 15, and 18 inches in the row. The results so far obtained in this test have been very inconsistent, but in general the closer spaced plats have produced the highest yields.

Methods of irrigation.—Three different methods of irrigation have been attempted for two years, but it has been impossible to follow the plans because of heavy rains during the irrigation season.

POTATOES.

The work with potatoes consists of variety tests and tests of cultural and irrigation methods.

Eleven standard varieties of potatoes were tested in 1913, together with 21 seedling stocks. These were tested in single plats on land which grew alfalfa in 1912. The highest yield with the named varieties was produced by the Pearl, which yielded 314.9 bushels per acre. The Eureka was second, with a yield of 247.9 bushels per acre. One of the seedlings, not yet named, gave the highest total yield in 1913. It produced 370 bushels per acre.

The irrigation and tillage work were the same as in 1912. The irrigation experiments were as follows: (1) Defer irrigation until the vines show need of water and then keep plants in a growing condition; (2) allow the plants to suffer before water is applied at each irrigation; (3) keep the soil moist throughout the season and the plants in a growing condition; (4) irrigate every second row alternately throughout the season; and (5) irrigate alternate rows throughout the season. The yields from the above methods in 1913 were at the rate of 156.9, 169.8, 180.5, 161.4, and 169.8 bushels per acre, respectively. As in the case of sugar beets, summer rains interfered with the irrigation plans, and no consistent results were secured.

The tillage work consisted of deep and shallow ditching preparatory to irrigation. The work was done in duplicate plats. The

potatoes were planted on land where alfalfa had been plowed up the previous year. The average yield in 1912 and 1913 for shallow ditching was 197.4 bushels per acre, as compared with 173.9 bushels per acre for deep ditching.

ORCHARD AND SMALL FRUITS.

The severe winter of 1912–13 was very hard on the fruit trees. Many varieties froze almost to the ground. Of the apple varieties the Stayman Winesap, Banana (*Winter Banana*), and Ralls (*Janet*) froze out completely. The Wealthy, Oldenburg (*Duchess of Oldenburg*), Yellow Transparent, and White Pearmain (*White Winter Pearmain*) froze back almost to the ground line, but in the spring these trees made a vigorous growth. The Anisim, University, Patten (*Patten's Greening*), Northwestern (*Northwestern Greening*), Hibernal, Florence Crab, Whitney Crab, and Hyslop Crab withstood the winter well. All the pears were frozen out, except one tree of Seckel, which came through the winter successfully.

The raspberries that were not protected during the winter froze to the ground line. The varieties included the Sunbeam, which is advertised as winter hardy. The best method of covering the raspberries is to bend the canes over and throw some soil on them to hold them down, then to take a plow with a very wide evener and throw two furrows on top of the canes. It may be necessary to go along with a shovel afterwards, in order to be sure that all the canes are well covered.

Thirteen varieties of strawberries were planted in 1913. All of these made a good growth. The yielding qualities of these have not yet been determined. In order to keep the soil from drifting on these plants during the winter it is necessary to seed oats or millet between the rows late in the fall.

TREES AND ORNAMENTALS.

A large number of trees were planted during 1913, including 250 yellow pine, 250 jack pine, 250 elm, 200 Scotch pine, and 1,000 green ash. Several hundred cuttings of willows and cottonwood were planted.

The American Green, Purple, and Lemey willows were discarded as unsuitable for general planting. Under irrigation these willows sucker very freely and have a tendency to produce a number of long switches each year. None of them could be trained to tree form. The Osage orange was entirely frozen out and eliminated. The black locust is of doubtful hardiness, as it has frozen back two winters in succession. The mulberry was eliminated by freezing out. Although many young poplars and elms froze during the winter of 1912–13, these trees may usually be relied upon. The hackberry and green ash have proved very hardy.

A large collection of trees and shrubs was received from the Office of Foreign Seed and Plant Introduction in the spring of 1913. Many

of these made a good growth during the summer, but their adaptability will not be known until they have passed through several winters.

VEGETABLES.

The testing of vegetables for farmers' gardens has been continued. For the past three years 33 different kinds of vegetables have been successfully grown. A general view of the garden is shown in figure 5. It has been found that by using a small amount of water the time of maturing vegetables may be hastened. In all cases early-maturing varieties should be selected in preference to late varieties. Hotbed

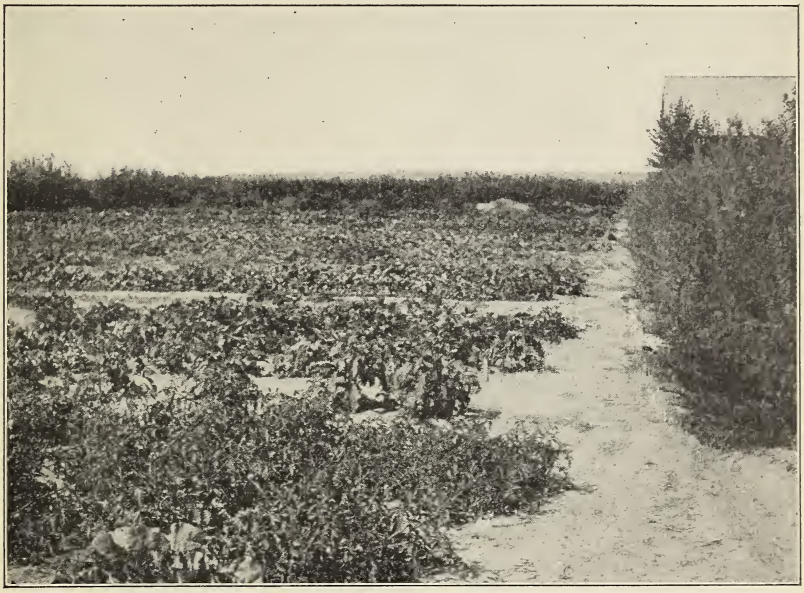

FIG. 5.—General view in the vegetable garden at the Scottsbluff Experiment Farm in 1913. During the past three years 33 different kinds of vegetables have been successfully grown.

or box seeding in a house should be made use of wherever possible in order to secure early plants in the spring. This is especially important with tomatoes, eggplants, pepper, cabbage, and cauliflower.

A detailed report of the work with vegetables prepared by the farm superintendent has been published by the Nebraska Agricultural Experiment Station.[1]

Approved:

WM. A. TAYLOR,
Chief of Bureau.

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[1] Vegetable gardens on irrigated farms in western Nebraska. Nebr. Agr. Exp. Sta. Bul. 142, 1914.

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